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ABSTRACT

This paper examines and summarizes the findings of recent research literature on the effects of color versus black and white learning materials on academic achievement in order to determine if the effect of the color variable is significant enough to warrant the added expense of purchasing colored instructional materials for primary school children. Young children ranging from 2 to 5 years of age prefer color over form when sorting and classifying stimuli. The research suggests that this preference is related to the fact that because the cognition of younger children is impulsive they respond to a vivid, dominant color cue more readily than to a subdued or neutral cue. Maturity is a factor in determining color effectiveness as observed when research found that illiterate adults, deaf children and older boys had a significantly greater response to the color variable in learning materials rather than to the black and white presentations. Color was also proven to be more effectively used in learning materials to emphasize differences, to aid in the retention of non-verbal material and to direct the attention of learners to informational areas of textual materials. In general then, age, maturity, and application appear to determine the effect of colored versus black and white learning materials on academic achievement. (Author/MP)

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THE EFFECTS OF COLOR vs BLACK AND WHITE LEARNING MATERIALS ON ACADEMIC ACHIEVEMENT

Verletta M. Peterson

Significance Of The Study

In the last ten years, many publishers have presented instructional materials with colored shadings over selected informational areas with the assumption that children learn and retain more knowledge from colored materials than from black and white materials. Educators note that the color-coded textbooks and colored illustrations, maps and other learning aids are more expensive than their black-and-white counterparts. Research in this area is both limited and dated. Most studies do not deal directly with this problem but rather with some associated factors such as preference of color over form. This study is designed to update previous research and to determine if the effect of the color variable is significant enough to warrant the added expense of purchasing colored instructional materials for primary school children.

REVIEW OF RELATED LITERATURE

Brian and Goodenough (1929) found that the child under three years of age preferred form to color in organizing his world. From three to six years of age, the child shifted to color over form as the preferred basis for categorization. After age six, form again became dominant over color.

Corah (1966) found that younger subjects, two to four years

old, made significantly more color choices when confronted with a color form problem than did the older subjects who were seven to nine years old. Research has also found that some older children and adults also respond on the basis of color.

Corah and Gospodinoff (1966) experimented with eighty children, forty preschoolers and forty third graders to determine the effect of color-form and whole-part perception in children and adults. The Spearman rank-order correlation was used to assess the relations between color and part scores in each group. The results showed that young children gave more color and part matches than did older children and briefly exposed adults gave more color and part matches than did control adults.

Katz (1971) found in her research using girls and boys from two private preschools in the Toronto area, ranging in age from 44 to 65 months that reflective children made more form responses to three given stimulus series, made more comparison glances and had longer response latencies than their impulsive peers. Age differences were not significant on any of the dependent variables. The data suggested that the cognition of younger children responded to color more than that of older children. She hypothesized that "Younger children are more impulsive and respond without giving adequate consideration to their choices and older children who are more reflective, respond slower and with more deliberation, thus choosing form over color." (p.748)

Fifty two and three year olds and fifty four year olds preschool children from day care centers were used in Brown's and Campione's (1971) research. The researchers first gave color preference tests to determine the best liked and disliked color of the subjects. Tests were also given to determine dimensional preference. The research revealed that whether the children were presented with a preferred or non-preferred color cue vs a dimensional cue, the color was always selected over the form. This research disagreed with earlier research which states that children are color dominant before the age of four at which time they become form dominant. Brown's and Campione's (1971) baseline condition which presented neutral cues resulted in a predominance of form choices. However, the introduction of a distinctive color cue resulted in the majority of four year olds being color dominant.

Corah (1964) experimented with ninety boys and ninety girls from kindergarten classes from two school systems in St. Louis County. The subjects were randomly assigned to six instructional sets. The instructional sets had little or no effect on color-form matching. The performance form set showed a weak tendency to induce form matching. The control levels favored form over color. The author concluded that young children have a stronger tendency to match on the basis of color than may be evidenced in their base levels of response.

Kagan and Lemkin (1961) found with subjects aged three to nine that the younger girls matched on the basis of color as opposed to form more often than the older girls and that older boys used color more often than the older girls. Corah (1964) found no significant sex differences in color-form preferences but he did find a highly significant age difference which he explained in terms of Piaget's concept of centration. That is a young child whose perception is not yet decentered would attend only to the dominant characteristic of a configuration such as color, whereas an older child would be free to attend to all characteristics including form.

Jones (1965) investigated the value of color as an aid to the visual discrimination of words and letters. One hundred ten nursery school children were given a pair of matching tests of English reversal letters. One in black and one in color. This was followed by another pair of matching tests in black and in color of English words transposed into an unfamiliar script. The results showed significantly higher scores for the colored version. It was discovered that matching the black words was at least three times as difficult as the same task in color.

Fifty boys and fifty girls ranging from preschool to third graders judged which of two silouettes was more like a third silouette which was identical to the one figure in color and the other in shape. Seventy two judgments were made which consisted of animals, outlines, scrambled figures and geometric figures. According to Harris, Schaller and Mitler (1970) the results showed that form matching increased with age both in number of subjects making form choices and the strength of their preference. In each age group the majority of children preferred form to color.

If as others have suggested, form preference is a measure of cognitive maturity, it would seem that children in the late sixties/early seventies were more mature than children in the thirties and forties. Perhaps the change stems from the more popular use today of form-board toys and games in the preschool and primary grades.

Milkman, Korvat and Pardo (1976) did a replication of Brian and Goodenough (1929) experiment regarding development of color-form preference in preschoolers. Subjects ranged from ages two through eleven years old. The children were placed in ten groups. The present experiment supported Brian and Goodenough's (1929) work where form was preferred over color by the youngest and oldest children. The highest color preference was by children aged three through five years old.

According to Miller (1974) "adding color to a textbook, atlas, or other classroom map significantly increases both the cost and the complexity of its printing". (p. 41). Miller's experiment with ninety six children equally distributed among grades four, five and six resulted in children at every grade level scoring higher on tests where maps were used having highly contrasting nonstandard colors than when using maps of conventional, neutral, background and markings.

Rudisill (1952) noted that colored illustrations were becoming more widely used in children illustrations and were more costly than black and white illustrations. The purpose of her

experiment was to investigate the validity of the opinion that color is the most important factor in children illustrations regardless of other characteristics of the picture. The study was populated with twenty seven kindergarten children and from one hundred fifty to two hundred children in each of the six grades. The results indicated that children of all age groups tested preferred realism over color but they preferred color over uncolored pictures.

Doehring (1960) administered a test of color-form attitude to ninety five deaf children and ninety hearing children ranging in age from eight to twelve years and also thirty-two hearing nursery school children and thirty-three hearing adults. The results indicated that more deaf children than hearing children based their responses upon color differences rather than form. He also found that males within both groups made more color choices than did females in both deaf and hearing groups. There was no change in the distribution of color/form attitudes between nursery-school groups and the adult group. There were no significant age difference involved in form/color preferences.

Vandermeer (1954) conducted two experiments to determine the relative effectiveness of using color vs black and white instructional films. Nineth and tenth grade students comprised the population. The results indicated that the color variable tend to aid the retention of learning rather than the immediate acquisition of learning. However color contributed significantly to the learning of those items where color was used to emphasize

differences.

Dwyer (1971) experimented with 261 students enrolled in the Psychology Two course at the Pennsylvania State University. Students were randomly assigned to one of nine treatment groups. The purpose of this study was to measure the relative effectiveness of eight type of visual illustrations to complement oral instruction and to test the hypothesis that color is an important instructional variable for facilitating student achievement of specific educational objectives. The results suggested that color appeared to be an important instructional variable in certain types of instructions for improving student achievement and that different type of color illustrations differ in the effectiveness of aiding student achievement.

Researchers, Katzman and Nyenhuis (1972) learned that color presentations increased recall only of non-verbal peripheral material presented by nonverbal cues more than the same presentation in black and white. There were no significant differences between color and black and white scores on verbal-central, verbal-peripheral, or nonverbal-central items.

Smith (1963) experimented with twelve adult subjects to determine the percent of effectiveness color coding is useful in visual search tasks. Items were placed randomly on the display field. Half of the displays had no color coding. The results showed that color coding markedly reduced both search and counting time and also counting errors.

Eight men and women participated as subjects to determine

the effect of color vs shape coding in information displays. According to Smith and Thomas (1964), the results explicity confirmed the significant effectiveness of color coding for a counting task.

Forty Army, Navy, and Marine male officers with normal color vision served as experimental subjects. The results demonstrated that color coding have a proportionally more more significant effect than the use of sensor lines, and color coding improved significantly the time to correct responses in a non-compatible display as reported by Poock (1969).

In his mail survey Matteson (1974) sent semi-personal and form letters with pink or white questionnaire to 2,123 members of a national professional organization. The results showed that among the group of those receiving the colored questionnaire returned almost 23% more forms than those having received the white questionnaire with the form letter. Color, however, made no difference in the response rate among those receiving the semi-personal letter.

Schmidt and Nzimande (1970) experimented with children and adults from Zululand in South Africa to provide cross-cultural data on color and form preference and the ability to classify. The results noted that rural Zulu children without schooling from age five to fourteen years and adult illiterate Zulu farm workers showed an overwhelmingly preference for color. The rural Zulu children with schooling and urban literate Zulu workers showed a shift from color to form.

SUMMARY

Research indicates that age, maturity, and application determine the effect of colored vs black and white learning materials on academic achievement.

Young children ranging from two through five years of age were found to prefer color over form when sorting and classifying stimuli. Research suggests that this preference is related to the fact that the cognition of younger children is implusive and therefore they respond to a vivid, dominant color cue more readily than to a subdued or neutral cue.

Maturity is a factor in determining color effectiveness as observed when research found that illiterate adults, blind children and older boys had a significantly greater respond to the color variable in learning materials rather than to the black and white presentations.

Color was also proven to be more effectively used in learning materials to emphasize differences, to aid in the retention of non-verbal material and to direct the attention of learners to informational areas of textual materials.

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